NAVPAT II

Biologists	Hydraulic Engineer	GIS
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ERDC – Vicksburg, MS

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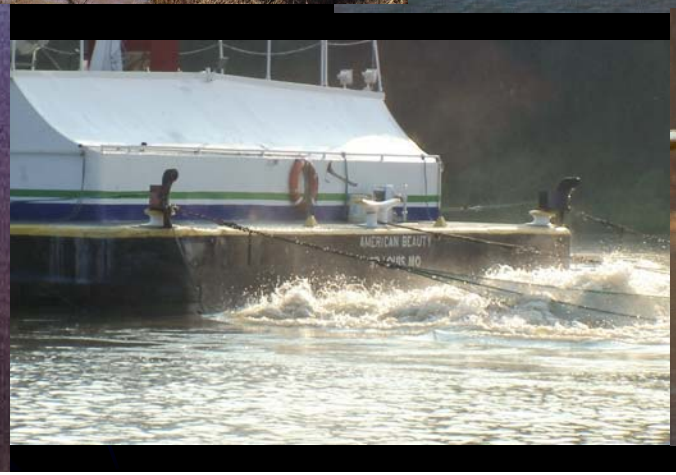
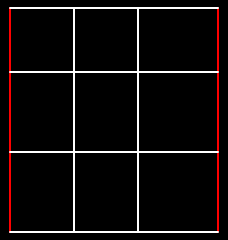
NAVPAT I – Terry Siemsen, Louisville District
NAVPAT II – Janet Cote, Huntington District

Source of Impacts

- Main channel – entrainment of eggs and larvae
- Channel “border” – substratum scour
- Shallow littoral – wavewash, drawdown, stranding



NAVPAT II
Biological Modeling



- Breaks channel into cells
- Physical variables calculated by cell
- Tow movements modify cell variables
- Using the HEP concept, habitat impacts are calculated for each cell, and summed for baseline and each alternative:

HSI * Area = HU

NAVPAT II
PHYSICAL VARIABLES

HABITAT SUITABILITY EXISTING CONDITIONS

- Depth
- Velocity
- Substrate

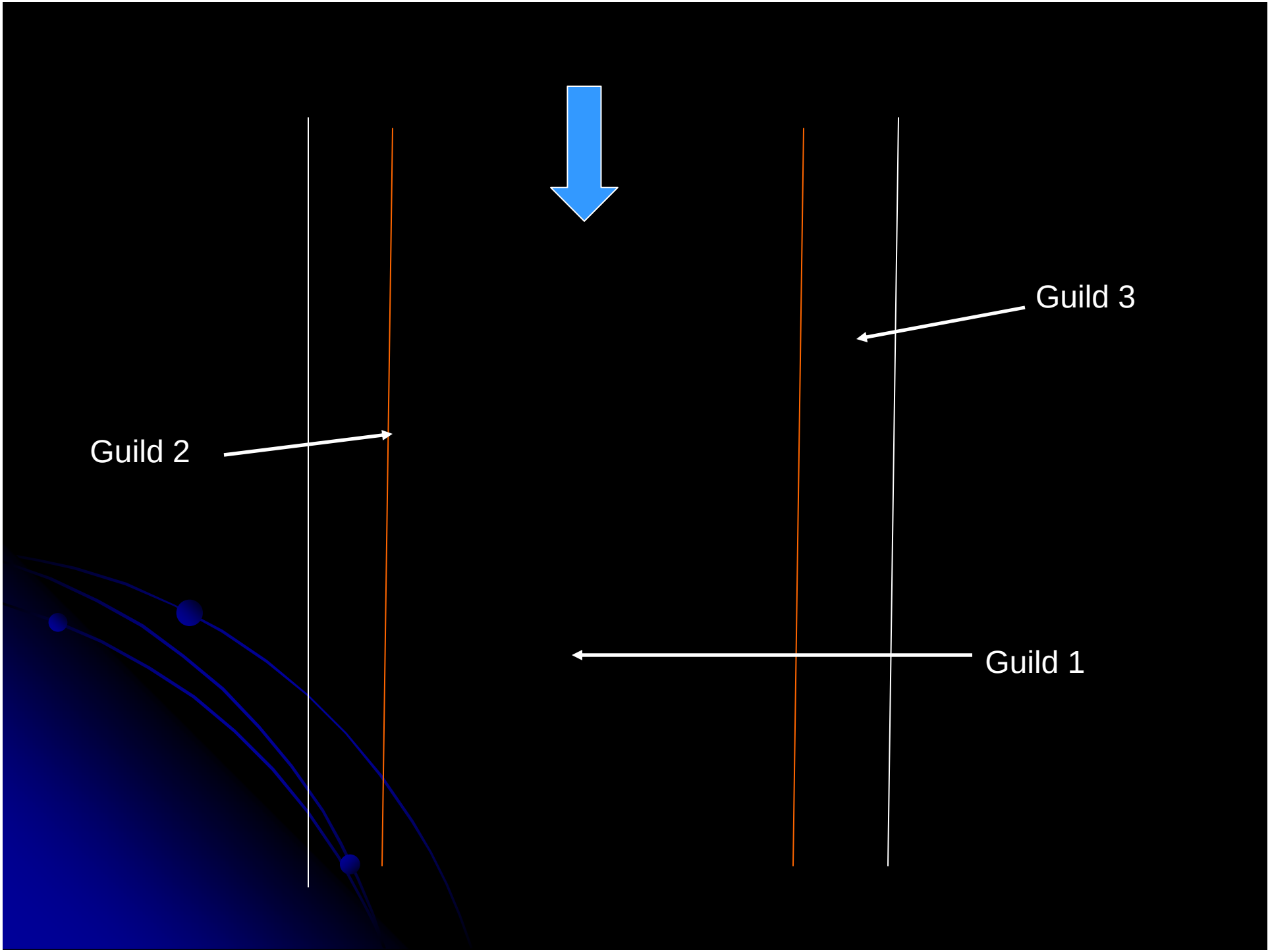
TOWBOAT DISTURBANCE MODIFIERS

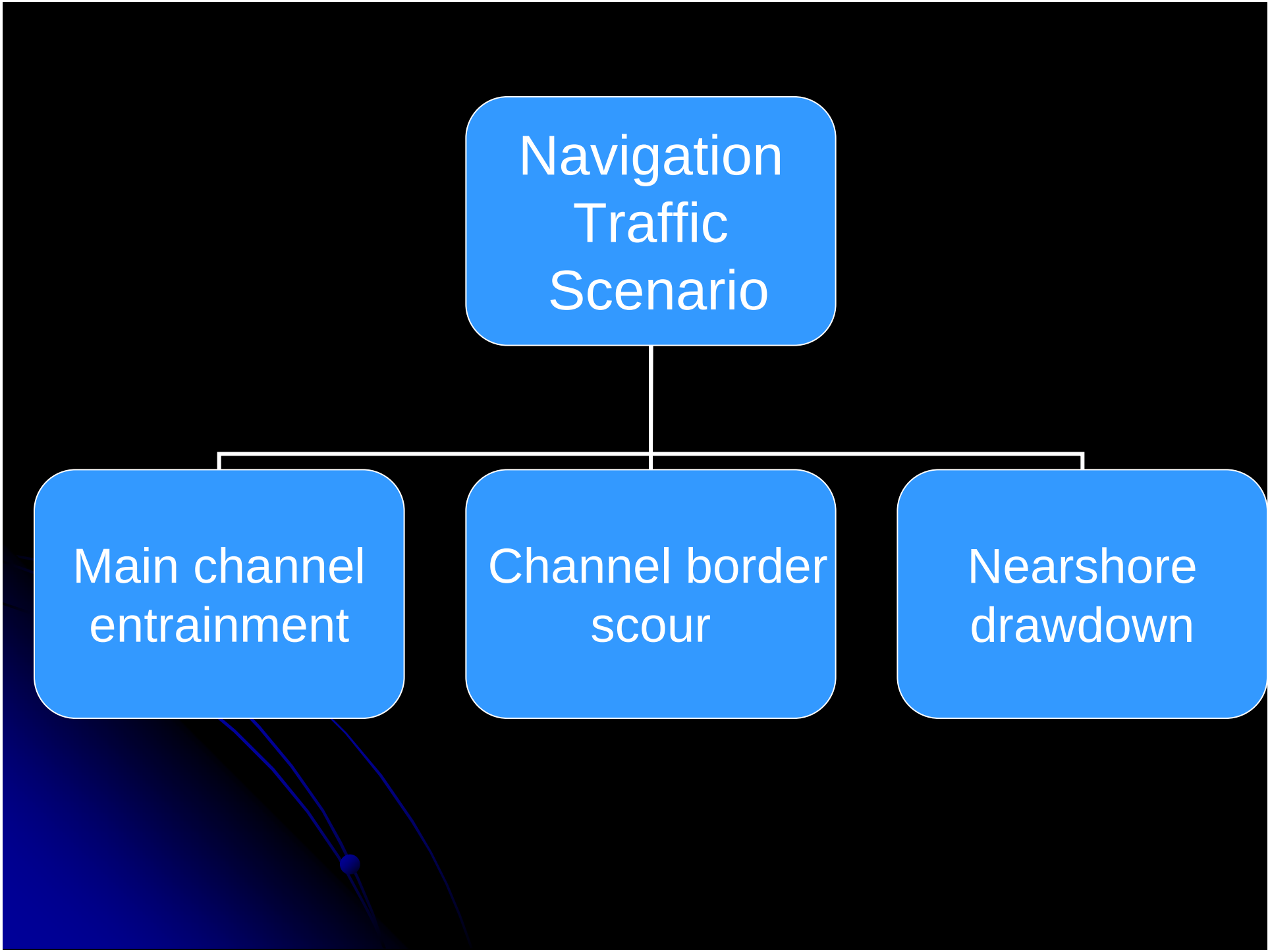
- Towboat-induced >velocity
- Substrate scour
- Shoreline water drawdown
- Entrainment

- **Sailing line (cells)**
- **Recovery rate**

Guilds

- Nine guilds accounting for 120 fish in the Ohio River Drainage
- Emphasized habitat preference and modes of reproductive
- Utilize spawning chronology to define seasonal applicability – early, mid, late season spawners


Guild 3
Guild 2
Guild 1


Navigation Traffic Scenario
Main channel entrainment
Channel border scour
Nearshore drawdown

MAIN CHANNEL ENTRAINMENT

Guild: pelagic eggs/larvae

Seasonal concerns: stage/spawning chronology

Spatial concerns: sailing lines/decay of effects

ENTRAINMENT MORTALITY

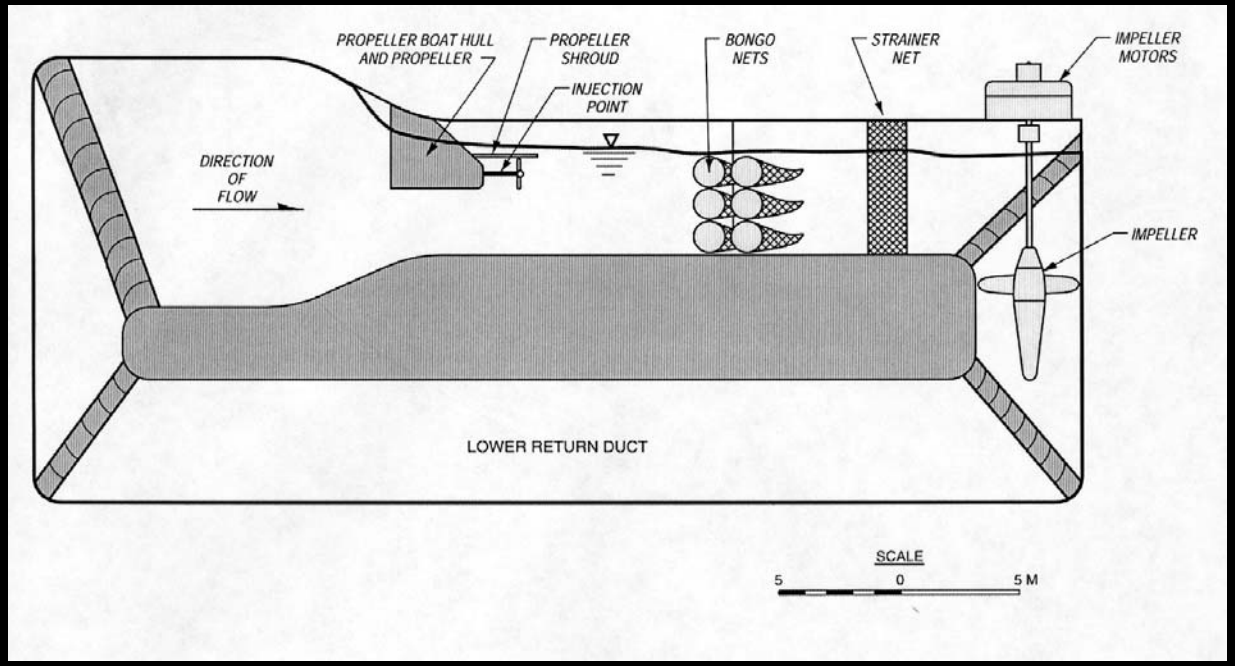
HSI values related to volume entrained

Recent lab and field data

Species and size differences

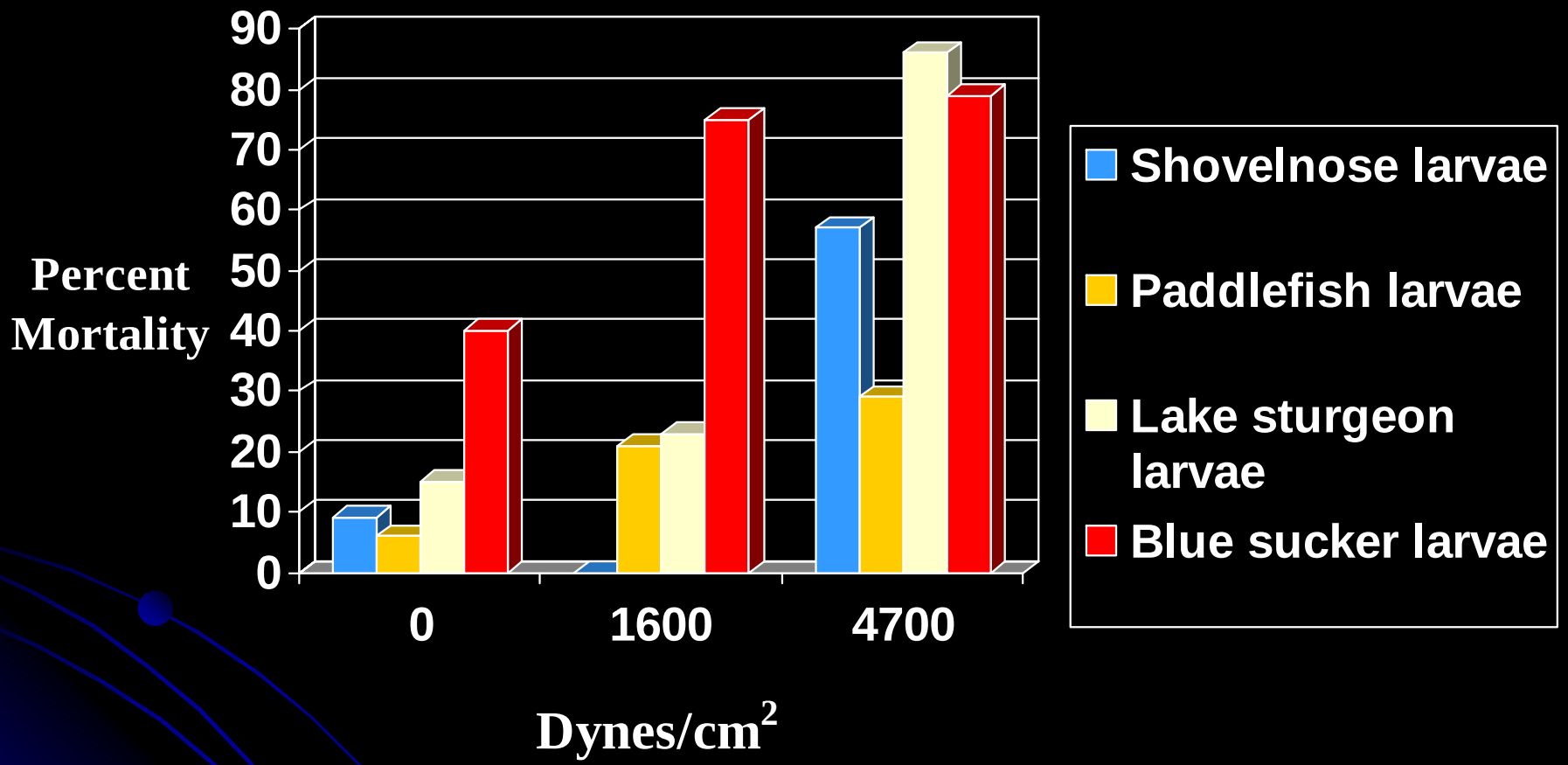
NAVPAT UNITS

Propeller Entrainment of Larval Fish



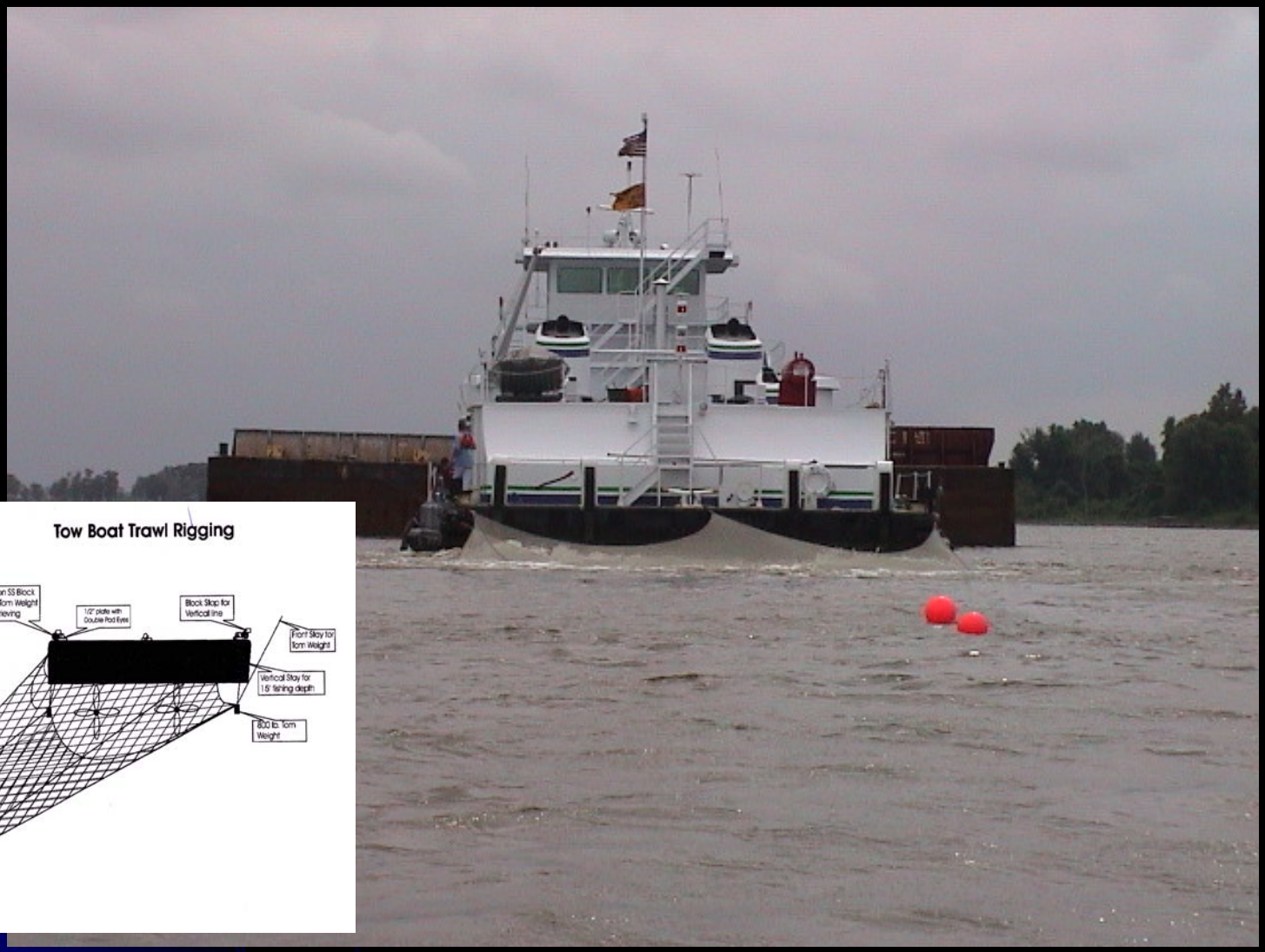
- Shovelnose sturgeon larvae – 14 mm
- Lake sturgeon larvae – 11 mm
- Paddlefish eggs and larvae – 14 mm
- Blue sucker larvae – 8 mm
- Common carp juvenile – 22 mm

Propeller-Induced Larval Fish Mortality



- No significant effect on eggs and juveniles
- Maximum shear stress: 6,300 dynes/cm^2

Adult Entrainment Study - ERDC



Retrieving Fish From Codend

Propeller Induced Mortality

CHANNEL BORDER SCOUR

Swiftwater demerals eggs: lithophilic, adhesive, nests

Seasonal considerations: stage/spawning chronology

Spatial considerations: sailing lines/decay of physical effects

TYPES of NEGATIVE EFFECTS

Behavioral disruption (nests)

Suspension of deposited eggs

Abrasion of egg chorion

NAVPAT UNITS

NEARSHORE DRAWDOWN and WAVES

Slackwater eggs and larvae

Seasonal concerns: stage, spawning chronology

Spatial considerations: narrow impact zone

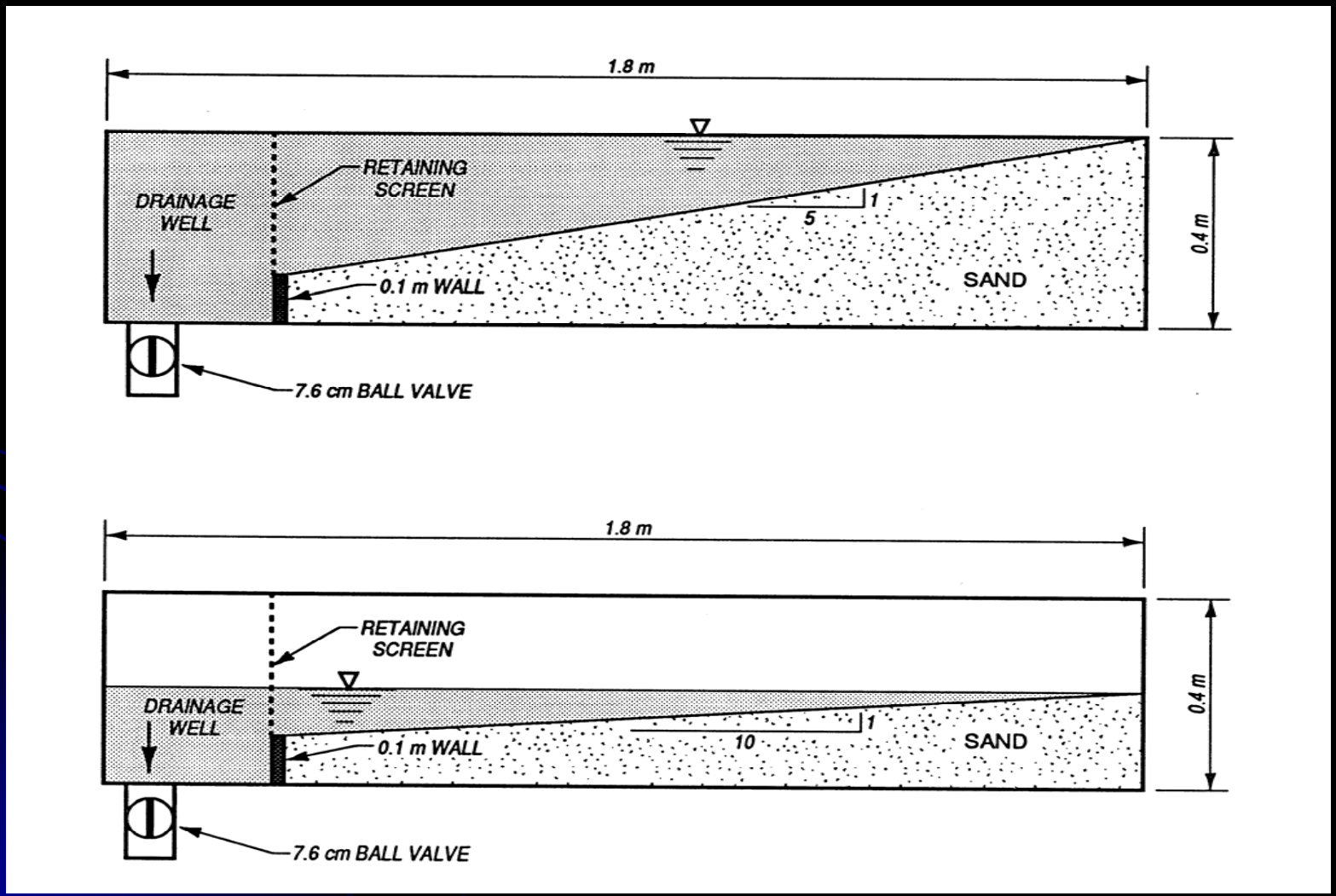
TYPES OF EFFECTS

Wave disturbance of nest-builders

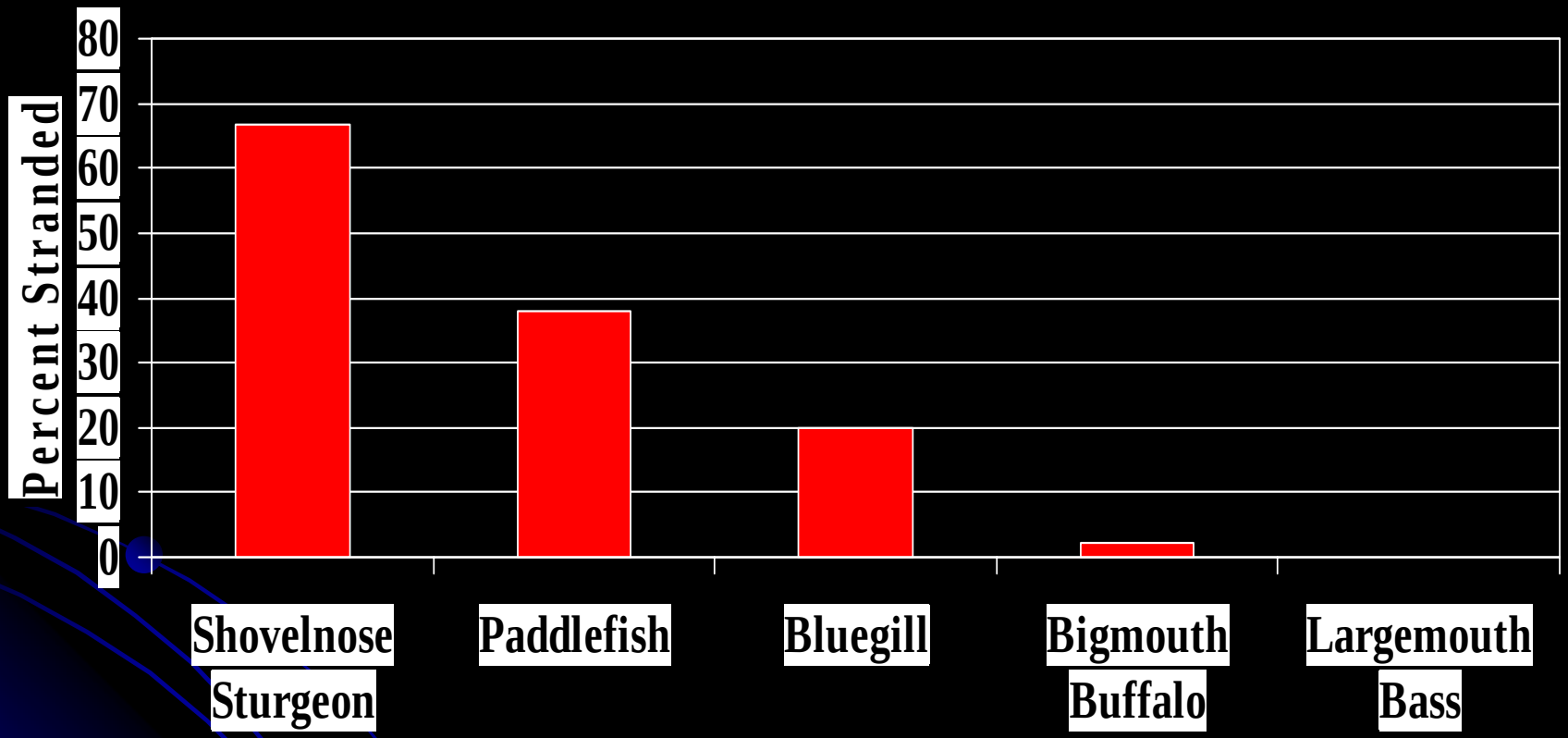
Drawdown stranding of larvae

NAVPAT UNITS

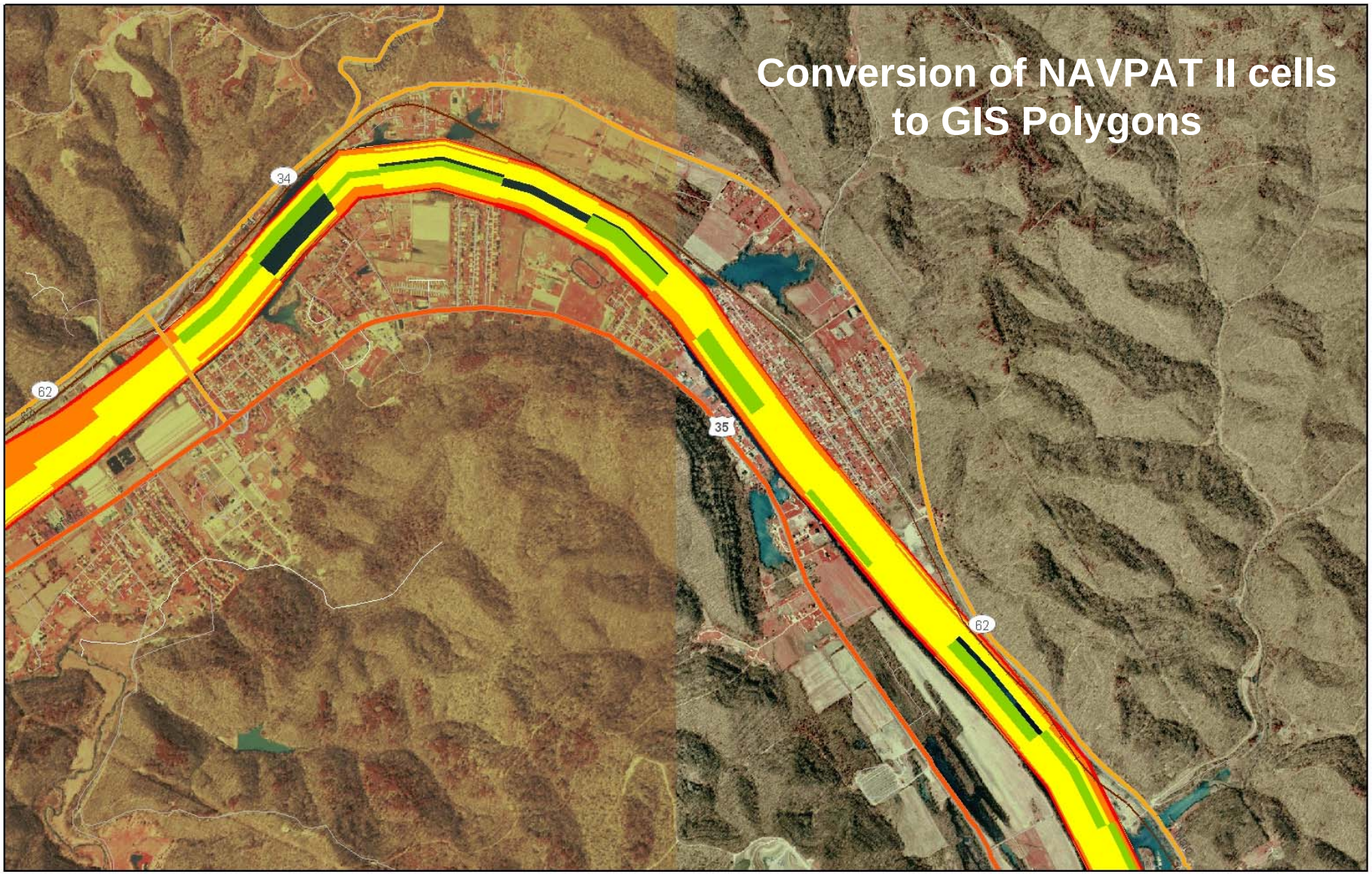
Adams, S. R., T. M. Keevin, K. J. Killgore, and J. J. Hoover. 1999. Stranding potential of young fishes subjected to simulated vessel-induced drawdown. Transactions of the American Fisheries Society 128:1230-1234.



Simulated Stranding of Larval Fish



Conversion of NAVPAT II cells to GIS Polygons



Area of Interest

Legend

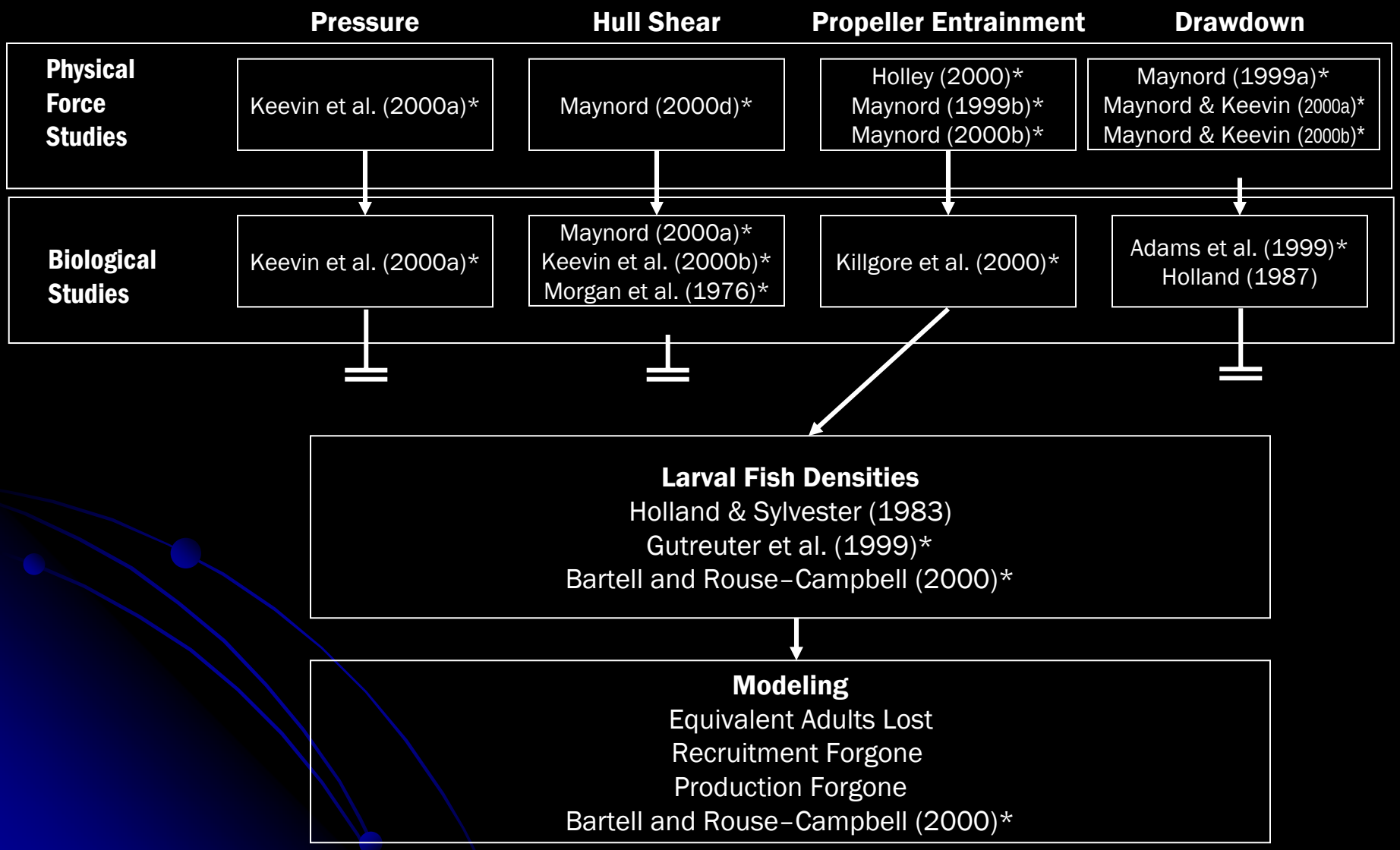
Habitat Suitability Index

- 0.052 - 0.400
- 0.401 - 0.600
- 0.601 - 0.800
- 0.801 - 1.000

NAVPAT Strengths

- Spatially explicit
- Can guide system-level mapping and restoration strategies
- Tailors HSI models to traffic stresses
- Moderately familiar and accepted method of quantification

Population-level Evaluation



*Indicates studies conducted for the Navigation Study

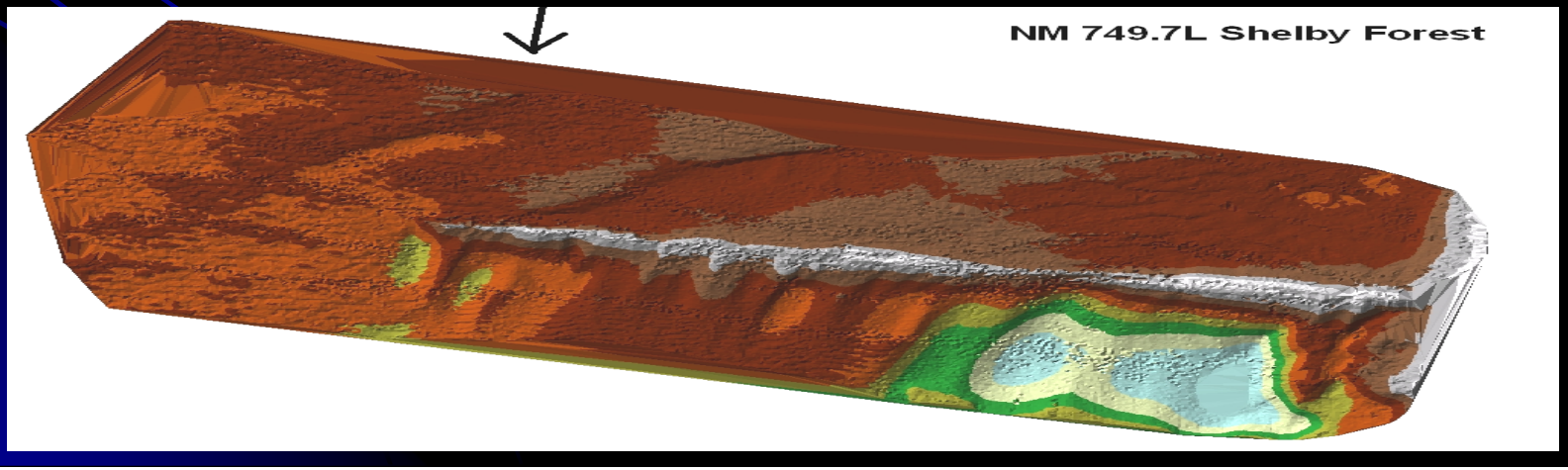
Comparison of Methods

Attribute	NAVPAT II	Population
Scope	Site Specific - System level	System-level
Approach	Habitat-based (more assumptions)	Demographic – based (fewer assumptions)
Requirements	Cross-sectional Data	Population statistics
Cost	Moderate	Moderate to Expensive depending on data availability

Mitigation???

Dikes

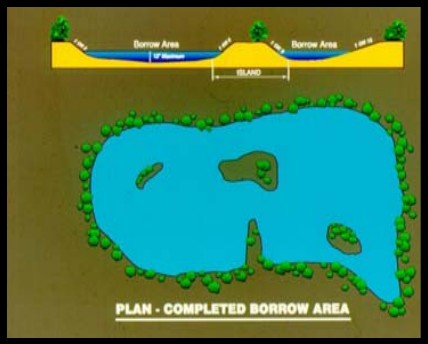
Goal: Develop environmental guidelines for dike notching that considers the placement and geometry of the notch to maximize benefits for fishes and macroinvertebrates



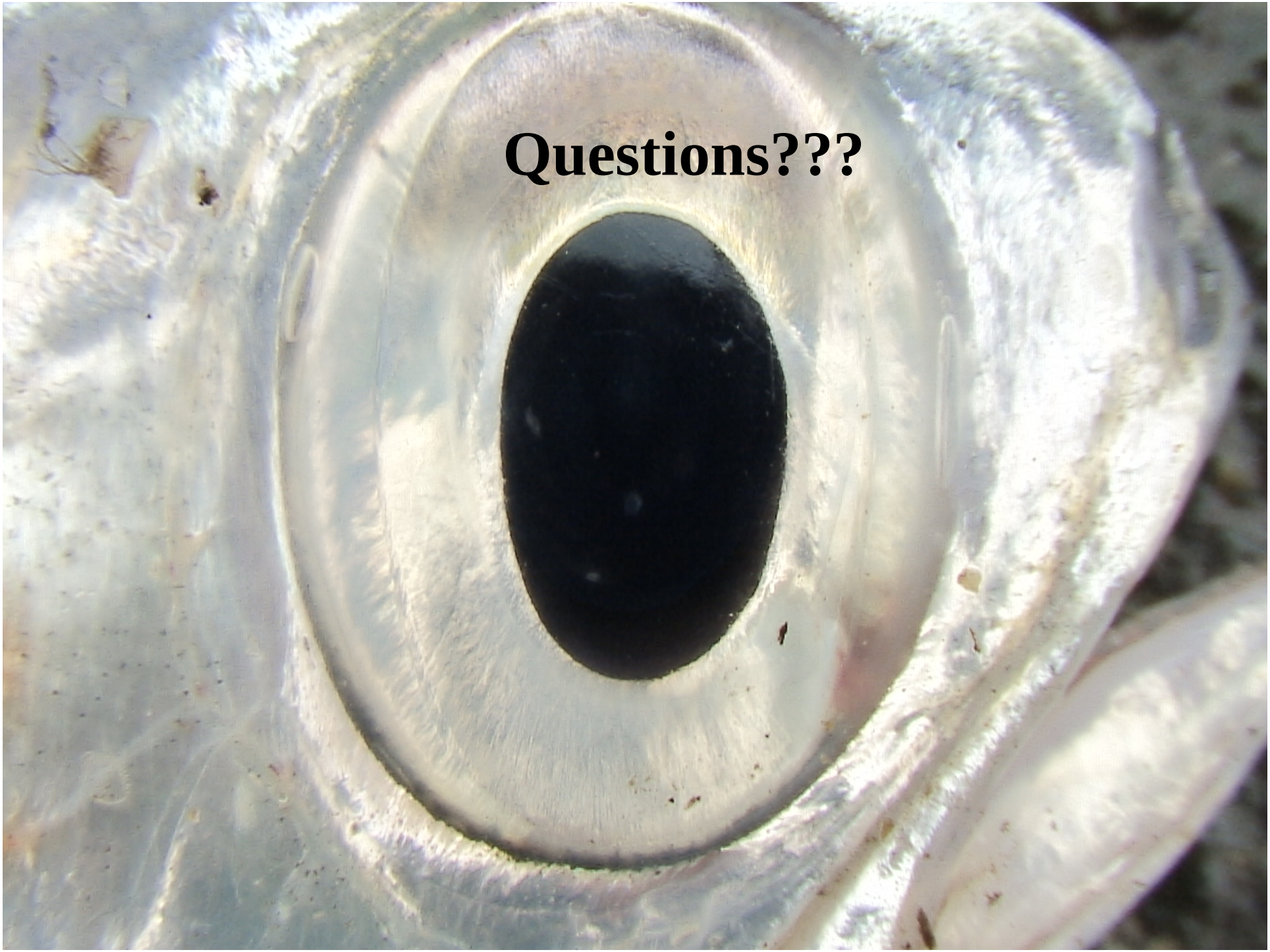
Gravel Bars

Secondary Channels

Borrow Pits



Floodplain Pools


Questions???